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10/539,225

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EXAMINER

QIAN, YUN

ART UNIT

PAPER NUMBER

1732

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

|                              |                                      |   |  |
|------------------------------|--------------------------------------|---|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/539,225 | <b>Applicant(s)</b><br>SAYARI, ABDELHAMID |  |
|                              | <b>Examiner</b><br>YUN QIAN          | <b>Art Unit</b><br>1732                   |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on 02 August 2010.
- 2a) ☒ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-3,6-11,13-16 and 20-25 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3,6-11,13-16 and 20-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                       | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Status of Claims***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 2, 2010 has been entered.

Claims 1-3, 6-11, 13-16, and 20-25 remain for examination. No claims have been amended, added, or cancelled.

### ***Previous Grounds of Rejection***

The rejection under 35 U.S.C. 102(b) as being anticipated by Leal et al. with respect to claims 1-3, 6-11, and 13 stands.

The rejection under 35 U.S.C. 103(a) as being unpatentable over Birbara et al. in view of Stein et al. with respect to claims 1-3, 6, 8-11, 13-16, and 20-24 stands.

The rejection under 35 U.S.C. 103(a) as being unpatentable over Birbara in view of Stein, and further in view of Sayari et al. with respect to claims 7, 20, and 25 stands.

***Previous Grounds of Rejection***

**Claim Rejections - 35 USC § 102**

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3, 6-11, and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Leal et al. (Inorganica Chimica Acta 240, p. 183-189, 1993).

Leal discloses an amine-functionalized mesoporous silica with covalently bound amines with an adsorption capacity of 10 cc/g at STP.

Regarding claim 2, the amines are bound to the entire surface.

Regarding claims 3 and 6, the surface is functionalized with 3-aminopropyltriethoxysilane (see section 2.1 ).

Regarding claim 7, since Leal's modification is the same as that of the instant specification (exposure of the silica to 3-aminopropyltriethoxysilane) it is assumed that the framework is similarly functionalized.

Regarding claim 8, the adsorbate is CO<sub>2</sub>.

Regarding claim 9, the silica must be hydrophobic, since it is wettable by xylene.

Regarding claims 10 and 11, the amines are bound to the hydrophobic surface.

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Regarding claim 13, the amines are grafted onto the surface.

### **Claim Rejections - 35 USC § 103**

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3, 6, 8-11, 13-16, and 20-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Birbara et al. (US Patent No. 5,876,488) in view of Stein et al. (Advanced Materials 12(19) p. 1403-1419, 2000).

Birbara teaches a mesoporous material with an amine-functionalized surface for use as a reusable carbon dioxide adsorbent. Birbara does not teach the use of mesoporous silica. Stein teaches that the surface of mesoporous silica may be functionalized with amines through a known grafting process (section 2.1.2) and that functionalized mesoporous silica is useful as an adsorbent (section 4.2.4). It would have been obvious to one of ordinary skill in the art at the time of the invention to use any porous support fitting the requirements of Birbara (a porous material with high surface area that is readily functionalizable with useful amines; see col. 3, lines 25-47), including mesoporous silica, with a reasonable expectation of success.

Alternatively, Stein indicates that mesoporous silica is particularly useful for its readily tunable pore diameters (Introduction) and that pore diameter has been recognized as a factor in adsorption performance (section 4.2.4). It would have been

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obvious to one of ordinary skill in the art at the time of the invention to use mesoporous silica in Birbara's adsorption device in order to allow fine-tuning of the pore diameter for maximum performance.

Neither Birbara nor Stein teaches the claimed CO<sub>2</sub> adsorption capacity. However, because the references teach the same structure (amine-functionalized, mesoporous silica) made by the same process (grafting or co-condensation), the CO<sub>2</sub> adsorption capacity is assumed to be the same.

Regarding claim 2, Stein teaches that amines may be covalently bound to the surface of the silica (section 2.1.2).

Regarding claim 3, Stein teaches that trialkoxysilanes may be used for grafting (section 2.1.3).

Regarding claim 8, Birbara teaches carbon dioxide adsorption.

Regarding claim 9, Birbara teaches a method of dry-scrubbing in which the amine-functionalized support is exposed to a gaseous stream containing an acid gas.

Regarding claim 10, Stein teaches that amines may be covalently bound to the surface of the silica (section 2.1.2).

Regarding claim 11, Stein teaches that areas not covered by grafting may be hydrophobic or may be made hydrophobic (section 2.1.3).

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Regarding claim 13, Stein teaches that grafting may be accomplished by exposing the silica to silanes containing the desired functional groups.

Regarding claim 14, Stein teaches that the functionalized silica may be formed by co-condensation (section 2.3).

Regarding claims 15 and 16, Stein teaches that grafting may be accomplished by reacting surface groups with amines (section 2.1.2).

Regarding claim 20, Stein teaches that the surface may be functionalized by first adding alkyl halides to the surface and then displacing the halogen with the desired functional group.

Regarding claim 21, Birbara teaches that amine-terminated porous structures may be used in a dual bed system including pumps and valves (Fig. 1).

Regarding claim 22, Birbara teaches CO<sub>2</sub> removal.

Regarding claims 23-24, Birbara teaches that the sorbent may be in pellet form (col. 3, line 55). It would have been obvious to one of ordinary skill in the art at the time of the invention to use any appropriate binder, whether reactive or inert, with a reasonable expectation of success.

Claims 7, 20, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Birbara in view of Stein as applied to claims 1 and 9 above, and further in view of Sayari et al. (Chemistry of Materials, 13, 2001, 3151-3168).

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Birbara in view of Stein does not teach functionalization of an organosilica framework. Sayari teaches that organosilica provides superior structure control to that of the other mesoporous silica. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use Sayari's mesoporous organosilica as the support for Birbara's adsorbent in order to maximize structure control.

### **Response to Arguments**

Applicant's arguments filed on August 2, 2010, have been fully considered but they are not persuasive.

Regarding claims 1-3, 6-11, and 13 rejected under 35 U.S.C. 102(b) as being anticipated by Leal et al., applicants argue Leal grafted aminopropyltriethoxysilane on the surface of silica gel with ill-defined pore structure, having adsorbed only 9.1 cc/g at 1 atm of pure CO<sub>2</sub> (Remarks, page 1).

The Examiner respectfully submits that aminopropyltriethoxysilane grafted silica material of Leal is organosilica adsorbent, which meet the limitations of CO<sub>2</sub> adsorption capacity of at least 2.50 cc/g STD as the instant claims.

As such, the rejection of claims 1-3, 6-11, and 13 as set forth in the office action mailed on March 3, 2010, is proper and stands.

Regarding claims 1-3, 6, 8-11, 13-16, and 20-24 rejected under 35 U.S.C. 103(a) as being unpatentable over Birbara et al. in view of Stein et al., applicants argue the framework functionalized mesoporous organosilica is fundamentally different from surface modification (Remarks, page 2).



The Examiner respectfully submits, as set forth in the office action mailed on March 3, 2010, Birbara et al. teaches a porous supported amine sorbent for absorbing CO<sub>2</sub>.

Although Birbara et al does not specifically teach the use of mesoporous silicates as the porous support as the instant application, Stein et al. teaches the surface of mesoporous silica (i.e. MCM-41) may be functionalized with amines (i.e. 3-aminopropyl, and (MeO)<sub>3</sub>SiCH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>NH<sub>2</sub>) (Section 2.1.2, and Table 1, Section 2.3) through a known grafting process (section 2.1.2) and that functionalized mesoporous silica is useful as an adsorbent (section 4.2.4). It would have been obvious to one of ordinary skill in the art at the time of the invention to use any porous support fitting the requirements of Birbara (a porous material with high surface area that is readily functionalizable with useful amines; see col. 3, lines 25-47), including mesoporous silica, with a reasonable expectation of success.

Neither Birbara nor Stein teaches the claimed CO<sub>2</sub> adsorption capacity. However, because the references as combined teach the same structure (amine-functionalized, mesoporous silica) made by the same process (grafting or co-condensation), the physical properties of composition (i.e. CO<sub>2</sub> adsorption capacity) would necessarily follow as set forth in MPEP 2112.01(II).<sup>1</sup>

Therefore, the invention as a whole would have been *prima facie* obvious to one of ordinary skill in the art at the time the invention was made.

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<sup>1</sup> “Products of identical chemical composition can not have mutually exclusive properties.” A chemical composition and its properties are inseparable. Therefore, if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. In re Spada, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990).

Applicants further argue Birbara et al. does not teach claimed mesoporous material as the porous sorbent (Remarks, page 3-5).

Applicant's arguments against the reference of Birbara et al. are not found persuasive.

Because, note that while Birbara et al. do not disclose all the features of the present claimed invention, it is not necessary for each reference to teach every limitation of the claim, *In re Nievelt*, 482 F.2d 965, 179 USPQ 224, 226 (CCPA 1973), *In re Keller* 624 F.2d 413, 208 USPQ 871, 881 (CCPA 1981). Rather this reference teaches a certain concept, a porous supported amine sorbent for absorbing CO<sub>2</sub>, and in combination with the references of Stein et al, discloses the presently claimed invention as set forth in the office action mailed on March 3, 2010.

With regard to Stein, applicants argue that it would have been counterproductive to use mesoporous silica or organosilica and fill their pores with amine-containing molecules according to Birbara's procedure. Stein describes the use of mesoporous silica made hydrophobic via surface modification by small organic species such as phenyl, trimethyl or vinyl groups (Remarks, page4-5).

The Examiner respectfully submits, as set forth in the office action mailed on March 3, 2010, Stein et al. teaches functionalized the surface of mesoporous silica (i.e. MCM-41) with amines (Section 2.1.2) through a known grafting process (section 2.1.2) and that functionalized mesoporous silica is useful as an adsorbent (section 4.2.4).

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Therefore, the functionalized mesoporous silica taught by Stein not only contains small organic species but also contain amines such as  $(\text{MeO})_3\text{SiCH}_2\text{CH}_2\text{CH}_2\text{NH}_2$  as the instant application.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features, upon which applicant relies (i.e., higher  $\text{CO}_2/\text{N}$  ratio, narrow pore size distribution, a unique surface hydrophobicity, eliminating diffusion problem), etc.) are not recited in the rejected claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir.1993).

### ***Conclusion***

All claims are drawn to the same invention claimed in the application prior to the entry of the submission under 37 CFR 1.114 and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the application prior to entry under 37 CFR 1.114. Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first action after the filing of a request for continued examination and the submission under 37 CFR 1.114. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

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TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to YUN QIAN whose telephone number is (571)270-5834. The examiner can normally be reached on Monday-Thursday, 10:00am -4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Melvin Curtis Mayes can be reached on 571-272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/YUN QIAN/  
Examiner, Art Unit 1732

January 14, 2011

/Melvin Curtis Mayes/  
Supervisory Patent Examiner, Art Unit 1732